CLAIMS

1. A method, comprising:

receiving a sequence of pixel values representing a region of an image;

selecting one of the pixel values as an anchor value for reversible diffusion; and

applying the reversible diffusion to the sequence of pixel values beginning with the anchor value to obtain a sequence of smoothed pixel values.

2. The method as recited in claim 1, further comprising randomly selecting the anchor value from the sequence of pixel values.

3. The method as recited in claim 1, further comprising applying the reversible diffusion to a matrix wherein the matrix includes pixel values of the sequence of pixel values.

4. The method as recited in claim 3, further comprising selecting the anchor value from a pixel value at a predetermined matrix location.

5. The method as recited in claim 3, further comprising selecting the anchor value based on an entropy value associated with all pixel values in the matrix.

6. The method as recited in claim 3, further comprising selecting an anchor value based on an entropy value, wherein the entropy value corresponds to

that of a pixel value in the matrix and near to the matrix location of the pixel value associated with the anchor value.

7. The method as recited in claim 1, further comprising selecting the anchor value based on an entropy value associated with the location of a single pixel value.

8. The method as recited in claim 1, wherein the reversible diffusion uses one of a modulo reversible diffusion function, an XOR reversible diffusion function, and a differential equation reversible diffusion function.

9. The method as recited in claim 1, wherein the reversible diffusion averages the anchor value with an adjacent pixel value to obtain a smoothed pixel value for the adjacent pixel value while the anchor value remains unchanged.

10. The method as recited in claim 9, wherein the averaging includes weighting one of the pixel values being averaged.

11. The method as recited in claim 9, wherein the reversible diffusion is applied beginning at the anchor value and a pixel value adjacent to the anchor value and then applied along the sequence of pixel values, wherein each subject pixel value is averaged with an adjacent pixel value in the sequence to obtain a smoothed pixel value for the subject pixel value.

12. The method as recited in claim 11, wherein the pixel values are arranged in a matrix and the reversible diffusion is applied in a scan pattern in the matrix.

13. The method as recited in claim 12, wherein the anchor value is diffused along two direction vectors in the matrix by the reversible diffusion.

14. The method as recited in claim 13, wherein the two direction vectors are orthogonal to each other.

15. The method as recited in claim 12, wherein the anchor value is diffused in an arbitrary pattern reflecting a priori information about the underlying pixel matrix.

16. The method as recited in claim 12, wherein the reversible diffusion is applied over multiple iterations of the scan pattern.

17. The method as recited in claim 1, further comprising applying transform coding, wherein the sequence of smoothed pixel values undergoes an entropy transform.

18. The method as recited in claim 17, wherein the smoothed pixel values undergo a discrete cosine transformation.

19. The method as recited in claim 1, wherein the sequence of smoothed pixel values is restored to the sequence of pixel values by applying a reverse diffusion beginning at the anchor value and a pixel value adjacent to the anchor value.

20. The method as recited in claim 1, wherein the reversible diffusion comprises adding a number of adjacent pixel values in the sequence of pixel values together and dividing by the number of pixel values added together to obtain a smoothed value for a subject pixel value within the adjacent pixel values.

21. The method as recited in claim 20, further comprising weighting at least one of the pixel values.

22. The method as recited in claim 20, further comprising applying the reversible diffusion along the sequence of pixel values in a scan direction.

23. A noise reduction engine, comprising:

a buffer for storing pixel values;

a matrix selector for selecting dimensions of matrices for arranging the pixel values to represent regions of an image residue; and

a diffusion engine for reducing the magnitude of at least some of the pixel values and for reducing variability in the difference between adjacent pixel values in a subject matrix by diffusing magnitudes of pixel values into each other.

24. The noise reduction engine as recited in claim 23, further comprising an anchor value selector associated with the diffusion engine to select one of the pixel values in a given matrix as an unchanging diffusion boundary value for a diffusion process to be applied to pixel values in the matrix.

25. The noise reduction engine as recited in claim 23, further comprising an entropy calculator associated with the anchor value selector to select an anchor value based on an entropy value of one or more of the pixel values.

26. The noise reduction engine as recited in claim 23, further comprising a scan pattern engine to apply a reversible diffusion function to a matrix of pixel values in an order.

27. The noise reduction engine as recited in claim 26, further comprising an iteration manager to control an amount of diffusion to be applied to a matrix of pixel values by controlling a number of times that the reversible diffusion function is applied.

28. The noise reduction engine as recited in claim 23, further comprising a store of reversible diffusion functions suitable for different image residues.

29. The noise reduction engine as recited in claim 23, further comprising a reverse diffusion module to apply reverse diffusion using an anchor value.

30. An apparatus, comprising:

an MPEG encoder; and

a noise reduction engine for using reversible diffusion to smooth an error prediction energy image residue.

31. An apparatus, comprising:

an MPEG decoder; and

a noise reduction engine for reversing diffusion to restore an error prediction energy image residue to an unsmoothed state.

32. One or more computer readable media containing instructions that are executable by a computer to perform actions comprising:

receiving a sequence of pixel values;

selecting one of the pixel values as an anchor value for a reversible diffusion function; and

applying the reversible diffusion function to the sequence of pixel values to obtain a sequence of smoothed pixel values.

33. The one or more computer readable media as recited in claim 32 further including instructions to select the anchor value at random.

34. The one or more computer readable media as recited in claim 32 further including instructions to apply the reversible diffusion function to a matrix of the pixel values representing a region of an image.

35. The one or more computer readable media as recited in claim 32 further including instructions to select the anchor value from a pixel value at a fixed matrix location.

36. The one or more computer readable media as recited in claim 32 further including instructions to select the anchor value based on an entropy value calculated from one or more pixel values in the matrix.

37. The one or more computer readable media as recited in claim 32 further including instructions to select the anchor value based on an entropy value of a pixel value in the matrix adjacent to the pixel value used as the anchor value.

38. The one or more computer readable media as recited in claim 32 wherein the reversible diffusion function uses a differential diffusion equation to determine how much diffusion to apply to a matrix of pixel values.

39. The one or more computer readable media as recited in claim 32, wherein the reversible diffusion function averages the anchor value with a pixel value adjacent to the anchor value in a matrix to obtain a smoothed pixel value for the adjacent pixel value while the anchor value remains unchanged.

40. The one or more computer readable media as recited in claim 39, wherein the averaging includes dividing one of the pixel values being averaged to reduce the magnitude of a smoothed pixel value obtained by the reversible diffusion.

41. The one or more computer readable media as recited in claim 39, wherein the reversible diffusion function is applied over multiple iterations of the scan pattern until a threshold smoothness is obtained.

42. The one or more computer readable media as recited in claim 32, wherein the smoothed pixel values undergo an entropy transform.

43. The one or more computer readable media as recited in claim 42, wherein the smoothed pixel values undergo a discrete cosine transformation.

44. The one or more computer readable media as recited in claim 32, wherein the sequence of smoothed pixel values is restored to an original sequence of pixel values by applying a reverse diffusion function.

45. A method, comprising:

receiving a first sequence of pixel values;

receiving a second sequence of pixel values;

comparing the first sequence and the second sequence to obtain a third sequence of pixel values, wherein if corresponding pixels in the first and second sequences have the same pixel value then the corresponding pixel in the third sequence has a value of zero and if corresponding pixels in the first and second sequences do not have the same pixel value then the corresponding pixel in the third sequence has a value of the difference between the corresponding pixels in the first and second sequences;

selecting one of the pixel values from the third sequence as an anchor value for applying a reversible diffusion function to the third sequence; and

applying the reversible diffusion to the sequence of pixel values beginning with the anchor value to obtain a fourth sequence of smoothed pixel values.

46. The method as recited in claim 45, wherein the first, second, third, and fourth sequences of pixel values are scan lines of pixel values from video frames.

47. The method as recited in claim 45, wherein the first, second, third, and fourth sequences of pixel values are blocks of pixel values from video frames.

48. The method as recited in claim 45, further comprising repeating the method for multiple sequences of pixel values that compose a residue frame produced during a video compression process and transform coding a resulting smoothed residue frame.

49. The method as recited in claim 48, wherein the transform coding uses a discrete cosine transformation.

50. The method as recited in claim 45, further comprising transform coding the fourth sequence of smoothed pixel values and repeating the method.

51. The method as recited in claim 50, wherein the transform coding uses a discrete cosine transformation.